EVAPORATIVE WATER LOSS OF CAPTIVE COMMON BARN-OWLS

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Abstract — Evaporative water loss of the Common Barn-Owl (*Tyto alba*) was examined at temp experienced by these owls during incubation. Water loss increased ($P < 0.001$) with increasing ambient temp; however, it appeared that Common Barn-Owls in Utah would not be heat-stressed during incubation.

The Common Barn-Owl (*Tyto alba*) readily uses man-made structures (i.e., barns, haylofts, abandoned water towers) as roosting and nesting sites and adapts quickly to the use of nestboxes (Otteni et al. 1972; Marti et al. 1979). The use of nestboxes as nesting sites provides the barn owl with the advantageous effects of the sheltered nestboxes (i.e., decreased forced convection, less direct exposure to precipitation, and higher than ambient temp) during incubation (Hamilton 1982). While there may be advantages for birds to conduct incubation within nestboxes, higher ambient temp may be a potential stressor. Birds may mitigate the effects of heat stress by panting, gular fluttering, or by postural thermoregulatory behavior (Bartholomew et al. 1968; Weathers 1972; Bartholomew and Dawson 1979; Dawson 1982).

The objectives of this study were to examine evaporative water loss of barn owls, and to determine whether water loss plays a crucial role during incubation at ambient temp below 32°C.

Materials and Methods

Two adult owls were captured in April 1980 at Welder Wildlife Foundation (Sinton, San Patricio Co., Texas) and a third adult owl was obtained from a local raptor rehabilitator (S. Ure, Salt Lake City, Utah). All birds were transported to the Environmental Physiology Laboratory at Utah State University, Logan, Utah. In 1981, three additional adult owls were captured post-incubation (April-May, Brigham City, Box Elder Co., Utah) and likewise transported to the laboratory facilities. All owls (♀) were housed in separate 3 x 3 x 2.5 m walk-in environmental chambers. Owls were fed a laboratory House Mouse (*Mus musculus*) diet and maintained on a 12L:12D photoperiod during all experimental trials.

Evaporative water loss of 6 captive barn owls was measured at temp that simulated nesting temp (2-30°C). An owl was equilibrated to the test temp for 2-3 d before an experiment and fasted for 6 h prior to the experiment. Each owl was weighed to the nearest 1.0 g on a platform balance and placed in a metabolism chamber. Owl weights ranged from 527.0-584.4 g with a mean value of 561.3 g (±27.8, S.D.). Metabolism chambers (56 x 46 x 43 cm) were constructed of plywood (1.3 cm) with a plexiglass sliding door unit (30 x 22 cm, inside dimensions). All edges of the chamber and door were sealed airtight with liquid plastic to prevent extraneous air flow. The wood was varnished and the inner surface of the chamber was covered with a plastic coating to prevent water vapor from being bound hydroscopically to the walls of the metabolism chamber. Condensation was never noted on the walls of a chamber. Air inlet and outlet valves were positioned on opposite sides of the chamber to allow airflow through the chamber.

After closure of the sliding door of the metabolism chamber, a diaphragm pump (dynapump) was started and respiratory gases were pulled through plastic tubing and then through a series of preweighed U-tubes which were filled with Drierite and weighed to the nearest 0.01 g, analytical balance. The weight change in the Drierite equalled the water vapor expired by the owl plus the atmospheric water vapor. A second set of Drierite U-tubes was connected in parallel to measure atmospheric water vapor (same pump). The rates of air flow from the metabolism chamber and the second set of tubes were equal. Water vapor expired by the owl (mg H_2O/g.h) was calculated as the difference in weight between the experimental and control tubes.

Air temp inside the metabolism and environmental chambers was monitored with thermistors (Model No. 1331, Control Equipment Co., Salt Lake City, Utah) and copper-constantan thermocouples and recorded on Rustrak chart recorders (Model No. 2133, Control Equipment Co.) and Wescor thermometers (Model No. TH50 TC, Wescor Co., Logan, Utah), respectively Thermistors and thermocouples were calibrated with a glass mercury thermometer. Temp was recorded every 15 min.

Statistical analysis of data presented here included curvilinear regression analysis and paired t-Test.

Results and Discussion

Evaporative water loss of barn owls was examined over a temp regime (2-30°C) which simulated ambient temp experienced by incubating barn owls (Hamilton 1982).

To test the physical effect of the metabolism chamber in altering the temp experienced by an owl, ambient (environmental chamber) temp and temp of the metabolism chamber were monitored during each experimental trial. Experimental temp was separated into 3 temp ranges: 0-10°C, 11-20°C and 21-30°C. In each temp range, the temp of the metabolism chamber was significantly higher ($P < 0.001$, paired t-Test) than the temp of the environmental chamber. The temp difference between the metabolism chamber and the environmental chamber was greatest ($P < 0.001$, 2.0°C) at temp which ranged between 0-10°C, and also was significantly higher for temp between 11-20°C (0.7°C) and 21-30°C (0.6°C). Therefore, owls utilizing nestbox metabolism chambers experience higher temp than would be seen if using open sites.

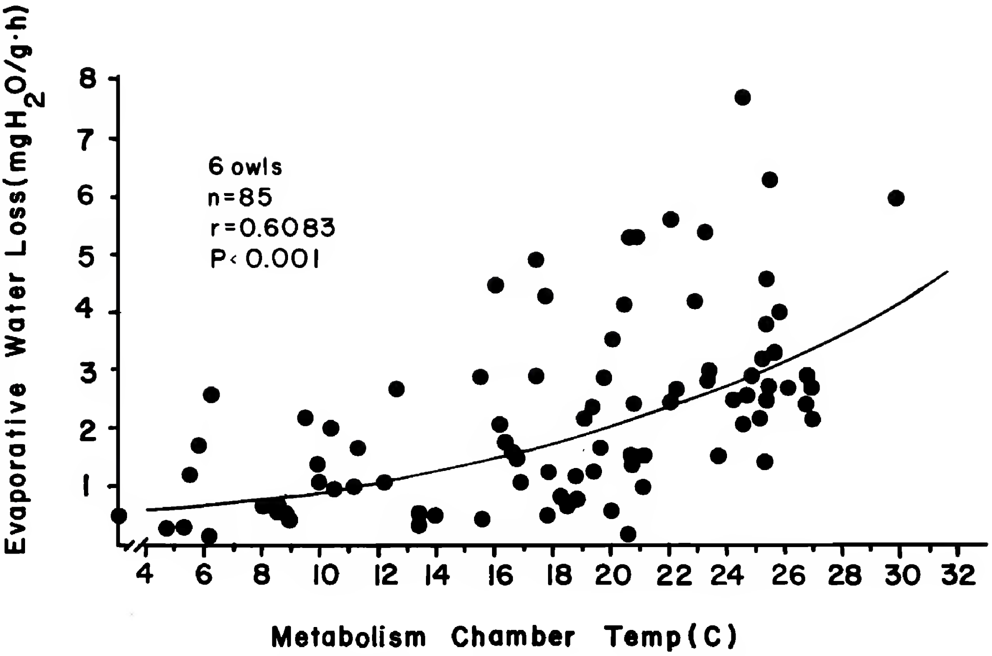

Figure 1: Water loss (mg H_2O/g.h) of 6 captive barn owls.

Eighty-five measurements from 6 captive barn owls showed that water loss (mg H_20/g·h) increased significantly ($P < 0.001$) as ambient temp increased (Fig. 1). Recent studies by Wunder (1979), Weathers (1979, 1981), and Dawson (1982) have examined climatic adaptation, physiological thermoregulation and water loss from birds and the data exhibited by the barn owl does not deviate from established patterns. Water loss of barn owls at ambient temp from 0-20°C is not different than data for non-incubating pigeons (*Lophophops ferruginea*) (Dawson and Bennett 1973) or Burrowing Owls (*Athene cunicularia*) (Coulombe 1970).

Coulombe (1970), Dawson and Bennett (1973) and Weathers (1981) have shown that the pattern of evaporative water loss of birds is an exponential function. However, water loss is essentially linear until approximately 35-40°C at which time birds become heat-stressed (Dawson 1982) and the water loss increased exponentially. This is also seen in Figure 1; at temp that mimics incubation temp (up to 30°C) water loss of barn owls is fairly linear and not very substantial. However, barn owls in Utah do not experience nestbox temp greater than 32°C during incubation (Hamilton 1982); therefore, the barn owl in Utah may be able to conduct incubation without an apparent heat stress.

In summary, birds must contend with numerous environmental stresses during incubation, one of which is heat stress. Some birds utilize roost sites with low heat loads (Barrows 1981), while other incubating birds use postural thermoregulatory behavior to reduce heat stress (Lustick et al. 1978, 1979; Bartholomew and Dawson 1979). The barn owl may escape heat stress problems during incubation by using nestboxes and by choosing a location where high ambient temp does not occur.

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